

Categorization and Modeling of Information Work for H-Journal Design

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This paper reports on a doctoral research project that examined the work of reference librarians in the health sciences domain. Categories of information work are derived and used to build Hyper-MedLib, a proof-of-concept h-journal. Findings from this study may be used in the design of electronic documents and information systems for the practice environments.

INTRODUCTION

Traditional user studies have paid very little attention to documents once they reach users.¹ Yet, the history of the evolution of print genres, especially those belonging to the tertiary class of knowledge-based literature such as reviews, suggests that these have risen to meet the needs of users (practitioners and researchers).² The development of the *ACP Journal Club* is a recent example.³ Information needs of practitioners (versus researchers or academic users) may be better met when electronic documents, defined as "documents that come with their own processing tools"⁴ are viewed as information systems and designed using an information work perspective. Sundaram calls such a document, a hypermedia journal (h-journal), and notes that its structure and application tools are determined by its target users.^{5,6,7}

Information work is defined as effort that involves the production, distribution, transformation, storage, retrieval, or use of information.⁸ Irrespective of the profession (engineering, medicine, law or librarianship) information has several roles or functions in work. For example, all practitioners need to keep abreast of current developments in their area. Information that meets this need fulfills a current-awareness information function. Some other information functions are tutorial, planning, and bibliographic.

The information work perspective for electronic document design is timely, because of the preponderance of information handling activities that the practitioner encounters in the course of her daily work (for general studies about the increasing numbers of workers who deal with information as a regular part of their jobs see Buckland,⁹ Bell,¹⁰ or Porat¹¹; for studies about clinicians, see Hersh¹²). Such a perspective is also important, because it recognizes the relevance of knowledge-based literature in daily work and takes into account the work environment. The information system perspective accedes that while system developers must separate documents (content and form) from interface/system, users will generally make no such distinction. A combination of these two perspectives therefore encourages the provision of a problem-oriented access (alongside subject access) that may be better suited to the practice environment.

In this paper, the term h-journal is used to define the genre of electronic documents designed to support information work (see Sundaram¹³ for a fuller discussion of the h-journal). The rest of this paper describes the design process - information work categorization and modeling - of Hyper-MedLib, a proof-of-concept h-journal that is under development.

METHODS

Health sciences reference librarianship was the domain chosen for the study, because the work of reference librarians can be described as information work. A variety of methods were used to collect the data needed for a categorization of information work in the health sciences reference domain and to build Hyper-MedLib. They are: a conceptual analysis of the research, review, and job description literature in the domain; a field study that observed library reference work; a document analysis of the print

corpus chosen for re-design; the development of Hyper-MedLib using the World-Wide Web (WWW) as a prototyping tool; and, a brief formative evaluation of the proof-of-concept.

The data from the conceptual analysis, field study, and document analysis were used to develop means-ends relations and data flow diagrams. The relations present an overview of information work in the health sciences library reference domain, that must potentially be represented in the design of Hyper-MedLib.

RESULTS

This was an exploratory study about information work that encompasses several different stages. Only the results of categorization and the resulting model for h-journal design are reported here. They are organized as the results of three distinct methods, the conceptual analysis, field study, and the means-ends analysis.

Conceptual Analysis

The conceptual analysis showed that seventeen categories of information activities potentially exist in the health sciences reference library domain (see Sundaram¹⁴ for further elaboration of these categories and details of the methods used). They are: 1) teaching, 2) reference work, 3) online searching, 4) information design, 5) information quality filtering, 6) electronic publishing, 7) archivist, 8) collection development, 9) inter-library loan, 10) management, 11) staff training, 12) professional development, 13) documentation, 14) meetings, 15) resource use/re-use, 16) technology alliancing, and 17) a miscellaneous category called others.

All of these activities make up the information work of a reference librarian. These activities can be decomposed along the lines of what Paisley calls information tasks, and he identifies five such tasks: decision-making, learning, problem-solving, calculation, and verification. Information tasks are similar among professions. For example, decision-making whether as part of a teaching activity or a medical diagnosis activity is similar. System design, and consequently h-journal design should accommodate the performance of

information tasks. An initial understanding of information task behavior in work was provided through the observational field study.

Field Study

Observation of practitioners in the selected domain showed that information work is an *interactive* flow of tasks that are carried out as part of a larger group of activities. Fifteen of the seventeen information activities that had been identified in the conceptual analysis stage were found in the work domain. These activities are often institutionally organized by function (these are regularly scheduled activities, such as reference and teaching) but sometimes their performance at other times, , as when reference questions come in the mail, is also required (in which case time has to be made for these activities).¹⁵ It was found that reference, online searching, teaching, and meetings tended to be functional activities (time was regularly scheduled for them). But many of the other activities, such as information design, information quality filtering, tended to be situational. Further, all of these activities are often punctuated by *pivotal* activities called *transformers*. Documentation, meetings, technology alliancing, and resource use/re-use were found to be the pivotal transformer activities in information work.

Documentation is simply defined as the creation, revising, updating, etc. of documents that record work, or are end-products of work (filling in forms, preparing bibliographies, monthly reports, plans, etc.). Meetings may be informal or formal and result in interaction (as when two colleagues meet in the hallway and discuss a problem). Technology alliancing is the act of providing specific systematic services which are a result of a formal consultation. Resource use/reuse is the selection among multiple choices of a specific configuration or re-aligning of services and products.

Properties of a transformer activity are: 1) it occurs in conjunction or as a normal part of a functional or situational activity, 2) often, it becomes the pivot of the activity within which it is embedded, and 3) it holds together the underlying processes by which input data flow is transformed into output data flow.¹⁶

Means-Ends Analysis

Means-ends analysis is a technique for the analysis of complex work domains, and is from the emerging field of cognitive systems engineering.¹⁷ The goal of this analysis is to make sure that the available *means* for achieving immediate *ends* within a task space are inventoried for representation in the system.

The means-ends overview (in brief) is shown in Table 1.

Means Ends Relations	Health Sciences Reference Domain Properties to Represent
Purposes and Constraints	Objectives: Assist Users; Use Information; Use Library Resources; Constraints: Large body of specialized biomedical reference resources; User group of physicians are subject to severe pressures and serious time constraints, resulting in user reliance upon librarians; Quality Information; Budget limits; Clientele limits;
Priority measures	Flow of funds; service to users according to their category; differing levels of worker expertise;
Abstract functions	Quality of service
General Functions	Reference work, online searching, bibliographic instruction, user education, administration, collection development
Physical Processes and Activities	Reading, Talking to Clients; Finding/Retrieving, Sorting/Filtering, Selecting, Using technology (computers, fax machines, etc.), troubleshooting equipment, filling out forms, maintaining statistics, writing reports, plans, preparing/editing teaching materials, guides, web pages, formulating plans, identifying needs, allocating resources
Physical Resources and their Configuration	Reference librarians, Support staff, Student assistants, Systems staff, Computer networks, Reference Sources, Collections, Local and remote databases, Teaching rooms...

Table 1. Means-ends relations

Sample detailed statements from the means-ends analysis are: 1) In the practitioner environment, reliance on own knowledge/skill, colleagues, and the availability of local resources (all in that order) is a key strategy in the performance of work. 2) Practitioners often perceived the performance of transformer activities, as the visible productivity factors of their work, and therefore any tool that seeks to support work must consider these activities prior to design.

Based on the means-ends analysis the iconic display of properties to represent in Hyper-MedLib is illustrated in Figure 1. Please note

that these icons are from the COREL DRAW clipart files and are representative of the opening screen display of the h-journal. The metaphor of the library is used for the concept of information work.

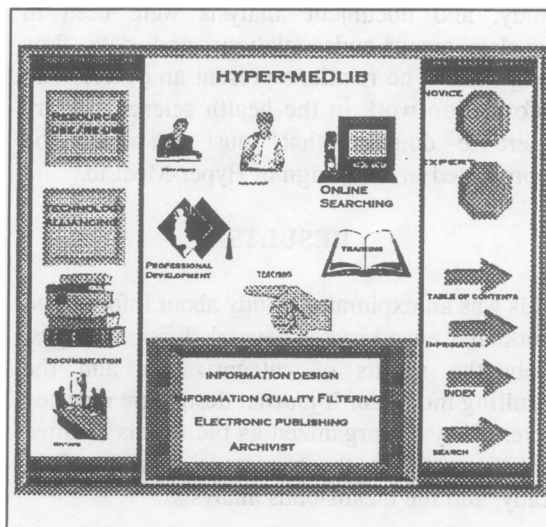


Figure 1: Some representative icons of information activities in a h-journal

The h-journal, Hyper-MedLib is based on the print corpus of Current Practice in Health Sciences Librarianship.¹⁸ It mimics the print model of a review publication through the provision of the imprimatur, table of contents, and index functions. It also permits a search (simple boolean searches) of the h-journal information space through the search function. It allows two levels of users - novice and expert - and this is again an option that is configured at the beginning of a session with the h-journal. It provides a problem-based access to the literature through the icon menu of the different information activities, and the button bar for the transformer activities. All document formats are integrated in the h-journal (types of multimedia files) and the aggregative WWW technologies are used as the prototyping technology (thereby integration and navigation problems are considerably lessened).

DISCUSSION

The benefits of a functional or problem-based approach may be illustrated by the "range of awareness" versus "range of relevant information" issue that surrounds the typical

practitioner.¹⁹ Typically, a large portion of the relevant information in any field lies outside the range of awareness of most practitioners. Hence the prolific growth of reviews and the vested interests of professional associations in these types of publications. Using the information work perspective in electronic document design offers an information tool that may extend the range of awareness of the practitioner, since the document is organized around their work practices. This has several implications for actual development of the h-journal. One, markup of the print document is considerably different. In-depth declarative markup is minimal and procedural markup is increased. Two, real-time interactivity must be seamlessly integrated - for example, the ability to interact serendipitously with colleagues, authors, or information professionals must be accommodated. Third, an awareness of the important communications media preferred by professionals must be incorporated. Lastly, since the h-journal application tools - for example, the integration of editorial support facilities, numerical systems that can perform statistical analyses of tables included, instruction and decision support - make the h-journal a highly evolved electronic document, belonging to the tertiary class of knowledge-based literature.

The h-journal model has some implications for professional associations. The fulfillment of information functions, such as current awareness, tutorial, planning, and bibliographic, can be viewed as important steps towards the establishment of a systematic life-long learning program. Usually these functions are fulfilled by professional associations in a number of ways. Publication of review journals and annual surveys help in the current awareness information function. Organization of conferences helps disseminate and communicate new information. Preparation of planning and documentation kits aid employee training, strategic planning, and other management aspects of daily work. The design and delivery of continuing education courses meets yet another function. The h-journal model can be used by professional associations to meet all these information functions in an integrated fashion.

CONCLUSION

The field of medical informatics probably exists because of the centrality of information - patient-specific and knowledge-based literature - in medicine.²⁰ Medical information systems then, must not only facilitate information use, but they should organize, synthesize, and present information, in ways that support work practices. The present subject organization of knowledge-based literature is woefully inadequate to meet the needs of practitioners. With the technological advances in publishing, electronic documents may be viewed as information systems, and new genres of tertiary literature, such as the h-journal designed and developed to meet the information functions of the practitioner in a way that makes Bush's vision of the memex particularly relevant to the world outside academia.²¹

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